The first 25 years of R.A.N. Airborne Radar

July 1947 saw the commencement of the R.A.N's carrier borne Fleet Air Arm and the introduction of the light fleet carrier HMAS *Sydney*. *Sydney*, in common with other carriers of the time, did not have an angle deck. The piston engined aircraft provided were Hawker Siddley Sea Fury, an attack aircraft and Fairey Firefly, a fighter bomber, both being acquired from Britain. The Sea Fury had no radar. The Firefly was equipped with the AN/APS-IV (Ash bomb) radar. The Transmitter receiver unit was assembled in a pressurised container, and housed in a nacelle which was suspended beneath the aircraft's starboard mainplane (wing). Firefly aircrew were Pilot and Observer, the latter sitting in his own cockpit astern of the pilot. Here the Observer had access to the Ash bomb's control panel, and a modified 'A' scan display.

Operating frequency of the Ash Bomb was a nominal 10,000 MHz using a cavity magnetron [1]. The intermediate frequency was 60 MHz, achieved using a klystron local oscillator. Maximum range was 100 nautical miles (NM) at an altitude of 10,000 feet. The antenna dish oscillated 40 degrees to port and starboard from the aircraft's heading at the rate of 1 sweep every 1.5 seconds. Pulse width was 0.6 microseconds. PRF was 1,000 for low ranges and 600 for the 100 mile range. Ash Bomb could also be used with radar beacons.The majority of the circuitry used thermionic valves, (transitor technology at that time was still in its experimental phase). With frequent heavy deck landings, equipment failure due to shattered thermionic valves was common. Fireflies and Furies were phased out of service in 1955.

In 1955 the R.A.N. acquired H.M.A.S. *Melbourne*, another light fleet carrier, but constructed with an angle deck, suitable for jet aircraft landings. The aircraft supplied were the De Haviland FAW Sea Venom Mk 53 fighter and the Fairey Gannet AS1. Sea Venom's radar was a 10 centimetre (3,000 MHz) air intercept AI 17, (ARI 5807)[2]. This fighter intercept aircraft carried a crew of two, with the Observer and Pilot seated side by side in the one cockpit. The Observer had control of the radar and directed the pilot during attack on a target. The transmitter, receiver and sector sweep dish antenna were mounted in the nose of the aircraft. The Design Authority for AI 17 was the Royal Radar Establishment at Malvern, Worcestershire, England.[3] ***The design of the AI 17 was fiendishly clever in the way that it could 'lock on' to a target. The parabolic dish had an off centre dipole mounted at its focal point which rotated so as to produce a conical beam. Acquired targets would cause the received echoes' to vary in amplitude about a 'bell curve'; hence the detector could steer the dish to centre the target and provide a relative heading to the 'Observer'. Prior to this 'fine target acquisition' the dish would perform a sequential horizontal scan (rather as TV sets do) to find a target. The AI 17 was considered state of the art due to its ingenious automated methods of target acquisition. Approximately 300 amperes of current were required to operate the AI 17 in search mode.***

The Gannet's role was anti submarine surveillance. This was made possible by the installation of the search radar, AS Mk 19B. Mounted inside the aircraft's fuselage about midships was a radome assembly comprising the transmitter,

receiver and antenna. Radar control was effected by the Observer seated in his own cockpit immediately astern of the pilot, or by the Crewman, seated in his own cockpit immediately astern of the Observer. For airborne operation, the Observer or Crewman would cause a fuselage panel located immediately beneath the radome to open up, and for the whole radome to be lowered clear of the fuselage by about 120 centimetres. Antenna continuous rotation through unobstructed 360 degrees, or sector sweep could then be controlled by the Observer or Crewman. Both Observer and Crewman had PPI display units. Mk 19B was a 3 centimetre device, transmission being achieved via a power klystron.

As well as having search radar capability, Gannets were equipped to operate submarine detecting sonobuoys.

The Grumann S2E & S2G Trackers were introduced to the FAA in 1966, and phased out in 1984 as replacements for the ageing Gannets. Trackers were fitted with AN/APS 88 and AN/APS 88A radar, a compact lightweight radar set (95 Kgm) whose major uses were Anti Submarine Warfare (ASW), weather warning and general purpose search. Sonobuoy and IFF capability were also designed into the system.(4). All information was displayed referenced to aircraft heading or to true north at the convenience of the operator. The area scanned by the antenna was selectable at full 360° scan or a variable width chosen sector from 40° to 140°. The antenna could be tilted from 10° up to 15° down. Range could be selected at anything between 3 and 240 NM. Operating frequency 9,400 to 9,500 MHz. for serial numbers 1 & 2, and was 8,500 to 9,600 MHz for serial numbers 3 through 11, with an intermediate frequency of 30 MHz. PRF varied with selected range at 2,000, 1,025 and 200 pulses per second. Similarly the pulse lengths varied at 0.35, 0.8 and 4.5 microseconds.

Twenty McDonnell Skyhawk A4G (pilot only) and TA4G (pilot & observer) were introduced to the R.A.N. commencing 1967, and being phased out in 1984.(5) These were carrier borne light attack fighter bombers. Skyhawk was fitted with APG-53A radar (6) which provided the pilot with search or mapping capabilities for navigational purposes, two modes of terrain clearance for obstacle avoidance in either azimuth or elevation plane, and air to ground slant range for weapons delivery. Automatic fire control was not provided.

End Notes:
1. Air Publication AP2276(A) vol. 1 Sect. 4 Sheet 18.
2. Air Publication AP4360C Vol.1 Sect. 6 Chap.2
3. AI 17 Radar System, Trials & Tribulations , J.S.Saywell
4. Handbook Operating Instructions AN/APS-88 NAVAIR 16-30APS88-1
5. F.A.A. of Australia
6. U.S. Chief of Naval Operations NAVAIR 01-40AVC-1